Title: A comparative evaluation of mercury(Ii) adsorption equilibrium and kinetics onto silica gel and sulfur-functionalised silica gels adsorbents

Author/Authors: Khairiraihanna Johari, Norasikin Saman, Hanapi Mat

Abstract: This paper presents a comparative evaluation of mercury(II) adsorption equilibrium and kinetics onto silica gel and sulfur-functionalised silica gel adsorbents. The silica gel was synthesised using tetraethyl orthosilicate (TEOS) as a precursor, while the sulfur-functionalised silica gel adsorbents were prepared through a co-condensation method using TEOS as a precursor with bis(triethoxysilylpropyl)tetrasulfide (BTESPT) and 3-mercaptopropyl trimethoxysilane (MPTMS) as sulfur ligands. The synthesised adsorbents were characterized by using SEM, FTIR, nitrogen adsorption/desorption (NAD), and EDX. A batch adsorption experiment was employed to evaluate the removal of Hg(II) by using the adsorbents. The study revealed that the Hg(II) adsorption capacity was found to be dependent on the initial Hg(II) concentration, agitation time, and pH of the solution. The Hg(II) adsorption capacities obtained for the SG-TEOS, SG-BTESPT and SG-MPTMS were 40.95, 93.32 and 102.37 mg/g, respectively. The Hg(II) adsorption was well fitted to the Langmuir isotherm models (R-2 > 0.935) and obeyed the pseudo-second order kinetics model (R-2 > 0.991). A further analysis of the kinetics suggested that the Hg(II) adsorption process was governed by both intra-particle and external mass transfer processes, in which film diffusion was the rate-limiting step.